DOCUMENT RESUME

ED 231 461 JC 830 309

AUTHOR Self, Charles C.
TITLE A Position on a Computer Literacy Course.
PUB DATE 20 May 83
NOTE 39p.; Paper presented at the University of Massachusetts-Amherst (Amherst, MA, May 20, 1983).
PUB TYPE Speeches/Conference Papers (150) -- Viewpoints (120)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Behavioral Objectives; College Role; Community Colleges; *Computer Literacy; Computers; *Computer Science Education; *Course Content; Course Objectives; Curriculum Development; Educational Benefits; *Educational Responsibility; Programing; Secondary Education; *Social Influences; Two Year Colleges

ABSTRACT

A position is put forth on the appropriate content of a computer literacy course and the role of computer literacy in the community college. First, various definitions of computer literacy are examined, including the programming, computer awareness, and comprehensive approaches. Next, five essential components of a computer literacy course are identified, followed by extensive rationales for their inclusion. These components are: (1) programming skills in the BASIC language; (2) the ability to operate modern hardware and use existing software; (3) the ability to communicate with computer specialists using correct computer terminology; (4) knowledge of the social, political, and economic impact of computers; and (5) an abstract concept of how a computer operates. The rationale sections state that programming, for example, is included to narrow the educational gap between the affluent and disadvantaged; increase students' self-esteem; improve their understanding of mathematical concepts, thought-processing techniques, syntax, and logic; teach the limitations of the computer; and help students overcome fear of the machine. Next, the exclusion of other possible content areas, such as consumer awareness and the history of computers, is defended. Finally, the role of community colleges in promoting computer literacy is stressed, indicating that the most computer illiterate segment of society (i.e., those 35 and older) is the educational responsibility of the two-year college. A list of behavioral objectives for the proposed course is appended. (LL)

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# A POSITION

# ON A

# COMPUTER LITERACY COURSE

PRESENTED BY

CHARLES C. SELF

AT

UNIVERSITY OF MASSACHUSETTS- AMHERST

MAY 20, 1983

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## INTRODUCTION

Traditionally, in papers of this type one begins with a definition of the subject under consideration. In this case it is impossible to provide a simple and precise definition. Hunter(1981) sums up this difficulty quite succinctly when she states that computer literacy is more like a Rorschach test than a discipline. She implies that computer literacy is a term into which we each project our values, experiences, and visions of the future as it pertains to computers. Despite the personalized nature of this concept, it might be profitable to examine selected definitions of computer literacy. The following definitions have been chosen for purposes of illustration:

> Knowledge about computers, knowledge of applications, experience in computer usage, use of computers in the learning process, and skills in programming,in addition to awareness of issues involved in a computer society (Elliott & Peele, 1975).

> Computer literacy is understanding how a computer works, as well as knowing about computers and their social and political implications (Stall, 1975).

> Computer literacy seems to range from the ability to load and execute programs in a useful manner to the abilities to write and understand languages like BASIC and machine code (Huntington,1982).

While the definition of computer literacy may be in doubt there seems to be little disagreement among authors as to the need for immediate implementation of computer literacy programs into the educational system. Masat(1981) calls computer literacy a national resource. He places it on a level with energy and raw materials. Klassen (1981) suggests that computer literacy may even be necessary for national survival. Other authors are equally emphatic about the importance of computer literacy and defend their positions on economic and political grounds (Beck,1980; Hunter,1981). The need for computer literacy is perceived by the general public as well as by the experts. Stevens (1980) reports a survey of teachers, student teachers, and teacher educators in which 92% of the sample advocated that secondary school students should be computer literate by graduation. Yet, for the same group, 94% did not feel qualified to teach computer literacy. Klassen (1981) states that computer

literacy is like apple pie and motherhood, it is un-American to oppose it.

If computer literacy is as important as it is perceived to be, then it seems reasonable to assume that it should be identifiable. When concepts and phenomena are not clear it is often useful to attempt to differentiate then from others of similar nature and to identify the characteristics associated with them. A review of the literature on computer literacy was initiated by me with the following premise in mind: It is possible to distinguish computer literacy from other computer competencies by identifying elements common to the majority of existing or proposed computer literacy courses. While it may appear naive to assume that humans can agree on anything, it has been my experience that most forms of behavior are not as diverse as they may seem and can at least be classified into a few fundamental types.

This expectation was rewarded as it was possible to identify three fundamental "schools of thought" on computer literacy. The first of these (which might be called the "programming approach") may be illustrated by the Richardson Independent School District of Richardson, Texas (Human Resources Center,1978). This computer literacy program has five specific objectives which are as follows:

The student will be able to:

1. Convert numbers, e.g., from binary to decimal, octal to binary, binary to hexidecimal.
2. Write a program in machine language.
3. Describe advantages and characteristics of an assembly language.
4. Write BASIC programs to manipulate string variables,N-dimensional arrays.
5. Write BASIC and FORTRAN programs for applications in probability and statistics, game theory, simulations, complex numbers.

These Texan do not fool around. If they say you will be computer literate, by golly.....you WILL be computer literate. It should be noted that in most cases reported by the Human Resources Center (1978) the "programming approach" was not this rigorous. In many school subscribing to the "programming approach" only a knowledge of BASIC was required.

In contrast to the concept that computer literacy requires the ability to program computers is the "school of thought" typified by Statz (1975). Statz's approach might best be called the "computer awareness" approach. This

view places heavy emphasis on the social and political implications of computers and minimizes programming skills.

Most educators today find both of these views too limiting and prefer a more comprehensive view of computer literacy (Stevens,1981) This view may be illustrated by the following statement:

> We believe that computer literacy must encompass the following domains: programming and algorithms, skills in computer usage, hardware and software principles, major uses and application principles,limitations of computers,personal and social impacts,and relevant values and attitudes. (Anderson et al.,1982)

The comprehensive approach represents an amalgamation of the older views and includes new concepts not previously considered.

The above quotation is not intended to be an all-inclusive list of the componenents of computer literacy as reflected by the "comprehensive school of thought" but rather represents this point of view. It was selected over equally impressive statements of the "comprehensive" point of view for one specific reason, it approximates my prejudices.

While it may be unwise to stray too far from one's own bias there are two areas of subject matter which are not mentioned in the preceeding quotation and perhaps should be included. Masat (1981) suggests that students should be exposed to a history of computers. A second possible addition to the quotation by Anderson et al.(1982) is the concept of consumer awareness. Deken (1982) argues that with the growth of home computers and computer related products ,which are flooding the market, every individual should be an intelligent consumer. His position may be summed up as follows:

> Even when we are not actively involved in the creative process, we have learned to choose our friends, and our books, and can evaluate movies, paintings,advertisements, scientific proposals, and humanitarian endeavors critically. A similar informed and critical outlook should be exercised toward technologies and interface methods which bring new experiences to our doorstep.

Indeed, there are many potential facets to computer literacy. It takes little imagination to include in a definition such things as appreciation of computer art and computer law. However, this paper will not address all the possible components of computer literacy which might, or perhaps should, be incorporated into a computer literacy course. The intent of this paper is to state my position

with respect to the content of a computer literacy course and to ascertain the role of computer literacy in the community college.

## MY VIEWS ON COMPUTER LITERACY

This discussion will begin with a statement of what I believe to be five essential components of a computer literacy course. Secondly, an attempt will be made to illustrate my reasons for the selection of each of the five areas. Concluding this discussion I will endeavor to defend the exclusion of some content areas which may be appropriate in a computer literacy course.

In my opinion, upon completing a computer literacy course a student should have:

1. Programming skill in the BASIC language.
2. The ability to operate modern hardware and use existing software.
3. The ability to communicate with computer specialists by using correct computer terminology.
4. Knowledge of the social, political and economic impact of computers.
5. An abstract concept of how a computer operates.

My rationale for including programming skills in a computer literacy course is considered first, not because programming skills are intrinsically more valuable than any of the other components, but because it is the most controversial of the five content areas.

In inner-city colleges, such as Bunker Hill Community College, the exclusion of programming from a computer literacy course is likely to perpetuate an existing condition. It has been suggested that when computers are introduced into suburban school systems computer programming and computer awareness are are the areas offered to the students.(Walker,1980). While in less affluent inner-city schools computer assisted instruction is offered. Walker's(1980) observations are pertinent . In checking his references ,I found that his source was Daniel Watt, a professor at MIT, and his publisher was the Brookline Public Schools. On thesurface it may not be too disturbing that the more affluent are telling computers what to do while the computers are telling the less affluent what to do. If, however, one places this in the context of social concerns for the late 80's and early 90's then the situation does become disturbing. Hunter (1981) points out that public schools are no longer

the route to equal opportunity and social mobility. Hunter attributes this to the fact that the public schools have not kept pace with our rapidly developing computer society. The children of the affluent have access to microcomputers, to data bases, and to practice in complex problem-solving. Rarely do the children of the less affluent have access to these opportunities. Using the following line of reasoning , Hunter (1980) issues a warning:

> There is a rapidly increasing gap between the have and have nots. Those of our society who know how to access and use our technology based tools are the people with the power to control industry, economics, and social decision making. Those who don't know how to get and use information, and don't understand the tools are increasingly unemployed and alienated. Some observers such as Parslow whom I mentioned earlier, fear we will experience rapid increases in crime and violence as a consequence.

From a practical point of view this society has three choices in dealing with the economically disadvantaged: (1) they can be educated (2) they can be supported from public funds or (3) they can be fought in the street. A humane point of view suggests that the first option is the most desirable.

It is probably true that some students will not profit from an exposure to BASIC, and some may be successful and still not like programming at all. But, it may also be anticipated that some students with poor math backgrounds, who would never have dreamed of programming as a career, will find that it is just their "bag". It is a common misconception that programming requires a high level of math skills. The truth is that programming in the higher languages is a verbal skill (Price,1980). Indeed, providing disadvantaged students with an opportunity to program may reap unexpected rewards. Stone (1980) reports an interesting observation. Disruptive students,with no academic interest,who have been removed from the mainstream of the educational process will,when left alone with computers and with no direction, begin to program them. Stone notes that some of the most socially disruptive students are "secret computer geniuses" when left to their own devices with a computer.

Many school systems, particularly large urban systems, are not providing students with the opportunity to try programming. It is my opinion that a student's eventual choice of career should be the result of a conscious decision and not an accident of birth. Many students who are economically and educationally

disadvantaged are provided the opportunity for furthur education at the community college level. The community colleges must provide these students with the chance to at least sample programming.

These comments in support of programming should not be construed as an attempt to diminish the significance of computer assisted instruction(CAI). The value of CAI has been demonstrated in several studies. Research with Spanish speaking children in California, and another with black women at Bennett College have suggested that individuals exposed to CAI show improved images of self (Walker,1980). CAI, as a topic in computer literacy can, in my opinion, be treated in the section dealing with the ability to use existing software.

If simply learning to use and operate a computer can lead to an increase in self-esteem does it not seem reasonable that learning to program and bring the "beast" under control might lead to even greater feelings of self-respect? While teaching FORTRAN to blind students, Ryan and Bedi (1980) have noted a growth by the students in "confidence, mobility, and feelings of accomplishment". If experience at Bunker Hill Community College can be transferred to other inner-city colleges then the potential positive impact on self-esteem is an important consideration. Ten years of involvement with students at Bunker Hill has suggested to me that the greatest obstacle facing these students as a group is low self-esteem. This attitude interfers not only with the students' achievement of personal goals but is also reflected in their attitude toward the college.

Another justification for teaching programming skills in a computer literacy course is the potential positive spin-off into other academic areas. Copple (9181) has examined a number of computer courses in secondary schools. She concludes that programming had positive effects on students' understanding of mathematical concepts and thought processing techniques. It has also been suggested that students' verbal skills are improved in the areas of both syntax and logic by the acquisition of programming skills (Masat,1981).

The general goals of computer literacy are also served by learning to program. Most authors seem to agree that some of the goals of computer literacy are: (1) To learn the limitations of computers, (2) To overcome fear of the computer, and (3) To make informed decisions as citizens of a democracy. It is impossible to see how such goals can be attained if an individual does not have some exposure to programming.

It seems likely that the user-friendly systems of today will perpetuate myths rather than dispel them. If students are to understand the limitations of a computer it is necessary that they recognize emotionally,as well as intellectually, that the activities of present systems are completely under human direction. While there may be a day on the horizon when true "artificial intelligence" is achieved, the systems of today are no better at solving problems than the man or woman who programs them.

What better way is there to overcome the fear of a computer than to make it do one's bidding? A powerful emotional impact occurs when sitting at a computer which has no software. The lifeless nature of the computer becomes an understanding rather than an intellectual concept. I can only think of one experience more powerful than perceiving the true nature of a computer and that was seeing a human cadaver stripped of it's skin for the first time. In both cases there was an emotional understanding of the word dead. With these experiences the childish fear of dead men and computers disolves as though it never was.

Understanding that computers are under human direction and should not be feared is important if one is to function as a member of a democratic society. Computer modeling has already appeared as a force in making political, economic, and social decisions. It is important for citizens to realize that a computer decision is no better than the knowledge of the man or woman who wrote the program. It is equally important to note that computers never lie, but liars sometimes write computer programs. Deken (1981) is as pro-computer as any one but he writes the following:

> It is vitally important for all of us to become critical of the answers generated by computerized analysis, and break the habit of accepting answers "from the computer" which we would not accept from a person or an organization. As you will realize instantly when you see the output from the first program you write, "from the computer" is shorthand for "by the rules of the person who wrote the program". In contemporary parlance, "that's how the computer does it" is often an easy cop-out, to avoid the necessity of understanding (or explaining) the rules and procedures which are being used. (The underlining represents my emphasis.)

There has already been an occurrence when the "chips" were down and a man had to make a decision between his "gut" feeling and a computer output(Vallee,1982). The first time the WIMEX system signaled (in error) that the United States

was under massive enemy attack there was no precedent for such an event and no reason to assume that the system was incorrect. NORAD gave immediate take-off orders to fighter-bombers from Montana to Canada and placed all ground forces on alert. The Strategic Air Command did not take-off nor were any rockets unleashed because that required a Presidential order. For seven minutes no one was able to contact the President, Vice-President, or the Secretary of Defense. One officer utilized this lag time well. He did not believe the Russians were attacking. The only rational explanation he could give for this feeling was that it was a period of relative "detente". Based on his "gut" feeling, he ordered his staff to run a check on the computer. They found the bug shortly before the President was contacted.

The term "programming skills" should not be interpreted to mean a professional level of competence in any language. No more than ten hours of a forty-five hour computer literacy course should be allotted to programming. Many computer literacy courses teach the BASIC language and I agree with that choice. BASIC is the simplest language to learn that will accomplish the purposes for including programming skills in a computer literacy course. BASIC was developed as an instructional aid for the teaching of fundamental programming concepts(Couger& McFadden,1975). I have observed children and adults sit at a microcomputer and be able to write simple programs after an hour of practice. This ability to obtain immediate success may be significant for motivational purposes. In addition, while other languages are available in home computers, BASIC remains the "native" language of these systems. Because of this, more people probably program in BASIC than any other language. Over one-half million personal computers were sold in 1980 (Vallee,1982). BASIC is, in a sense, becoming the universal language of the masses. It might be well that every "civilized" person have some knowledge of that language.

The objectives which I consider as minimum standards for proficiency in the BASIC language are listed in Appendix A.

In summary, it is my position that programming in BASIC should be included in a computer literacy course for the following reasons:

1. Each individual should have the opportunity to determine if he/she has the skills and/or desire to pursue a career in programming.

2. Learning to program enhances the student's feeling of personal worth.
3. Skills learned in programming have carry-over value into other academic areas.
4. It is impossible to meet the goals of computer literacy without developing some programming skills.
5. BASIC is an all-purpose language which is easy to learn.
6. Because of it's popularity, BASIC is likely to survive until programming in the English language becomes commonly available.

While the rationale for including programming skills in a computer literacy course may stand on it's merits, the other four components which I believe should be included in a computer literacy course must be justified on an assumption which may or may not be true. This assumption is that over the next decade the impact of computers on our society will be greater than it is at present. Since logic is no better than the basic premise on which it rests, it might be well to consider some of the factors which suggest that this assumption is true.

History has demonstrated that prophets are often stoned by the mob or have their heads served on a chaffing dish. This fact makes me nervous if I assume, as I must, that principles which operated in the past continue to operate today and in the future. The fate of prophets is probably well deserved as they seldom bring good news. Nevertheless, it is an end I would like to avoid if at all possible. Thus, if the following view of the future appears a bit rosey, perhaps it can be forgiven on the grounds of cowardness.

It has been stated that the Industrial Revolution has ended and the Computer Revolution has begun (Evans,1979). The United States is now making a shift from the production of material goods to the production, distribution and application of knowledge and information (Hunter,1981). These contentions seem consistent with findings of the U.S.Department of Commerce. In 1978, 51% of the U.S. work force was employed in the information technology sector of the economy (Vallee, 1982). These industries were responsible for 47% of the GNP that year.

The phrase "end of the Industrial Revolution" should not be interpreted as meaning the end of all manufacturing. Just as agriculture continued to exist during the Industrial Revolution, so will manufacturing flourish during

the Computer Revolution. What should be emphasized is that fewer individuals will be employed in the production of consumer goods (Halberstam,1983). The application of robots and other computer technologies will drastically reduce the number of workers required in the manufacturing process. These innovations are not in the realm of science fiction but are in existence today. Halberstam (1983) reported on a Japanese company, Nissan, in the April,1983 issue of Parade Magazine. Nissan will produce pickup trucks in Smyrna,Tennessee using a workforce of 220 imported robots and 2000 human employees. Executives of General Motors and Volkswagon have predicted that computer-aided design and assembly line robots will make obsolete 100% of the existing production line jobs within five years (Hunter,1981). General Motors is not only installing robots in factories but is also working on joint ventures with Japanese firms to manufacture robots (Halberstam,1983).

There is no way of predicting exactly how many workers will be displaced by these new technologies. It is possible that by the end of this century the United States may no longer be a producer of consumer goods. Today many nations rely on imported agricultural products for survival. In the future the United States may be equally dependent on import for most finished products. Changing world conditions have made this a very real possibility.

American industry is currently under great stress from aggressive competition from foreign nations. Japan has been extremely successful in competing with U.S. businesses. Japanese labor productivity has exceeded (or soon will) the United States in the following industries: (1) steel in 1973 (2) electric appliances in the mid-1970's (3)in the automobile industries, labor productivity is likely to exceed that of the U.S in the 1980's (Shishido, 1983).

The loss of American industry abroad is also likely to accelerate because of diminishing supplies of inexpensive accessible energy sources and raw materials (Hunter, 1981). In the recent past the United States has obtained about 83% of its energy requirement from domestic sources . West Germany was importing 50% , France 75% and Japan 90% (Abelson,1980). This relatively cheap energy gave the United States a tremendous advantage in industrial production. If current trends continue, there is good reason to anticipate that this energy advantage will reverse. The United States continues to rely on conventional energy while reducing its R & D commitment to alternative energy sources (Dickson,1982). In contrast, other nations such as Japan, West Germany, Italy and France have

made heavy commitments to nuclear power. Japan has 22 operating nuclear reactors and plans for 35 more plants by 1990 (Smith,1981). France's Socialist governement has reduced slightly it's national nuclear program (Walsh, 1981). The French Parliament has endorsed a proposal that six new plants be ordered in 1982 and 1983 instead of the nine sought by the previous government. The Soviet gas pipeline should also strengthen the energy position of France as well as supply 30% of the energy requirements for West Germany and Italy (Marshall,1981).

While oil prices are currently depressed, this is likely to be a temporary situation. The "oil glut" is, to a large extent, the result of worldwide depressed economic conditions (Landerberg, 1982). With an economic recovery under way, it is quite likely that this surplus will disappear rapidly. It is expected by the late 1980's that the world oil market is likely to tighten dramatically. The reason for this prediction is based on three assumptions: (1) OPEC countries will be consuming more of their own oil, (2) demand from industrializing Third World nations will continue to rise, and (3) production of oil is expected to decline in North America, the North Sea, and the Soviet Union (Marshall, 1982).

With increasing energy costs coupled with increased imports, American manufacturers will find themselves in an extremely unfavorable position. Countries, such as Japan, which currently produce high quality goods with low labor costs will be able to draw on cheap domestic energy sources to furthur undercut U.S. goods. Under these conditions there is little question that many U.S. manufacturers will fail. Stronger companies are likely to move their manufacturing operations abroad or enter a knowledge-related area of the economy. The rise of new automation makes it easier to move whole factories out of the United States. The following quotation is from Halberstam (1983):

> For it not just the rise of new automation here in America which is at stake. It is also the invisible automation exported overseas by American firms to subsidary plants throughout Latin America and Asia. Harley Shaiken, research economist at MIT, calls it super-automation, and in his view the new high technology permits American firms to export not just jobs but entire factories. When American companies talk about their most modern and highly automated plants they are inevitably talking of factories in Asia- which means finally fewer and fewer industrial jobs at home

While jobs bills to build roads may give some short-term relief to unemployment, it is obvious that a nation which takes in each others laundry can not long prosper. Circumstances are driving the United States into the Computer Age. The manufacture of knowledge, processing of data , and the distribution of information does not require large quantities of energy or raw materials. If the reader questions that the United States is shifting rapidly from a manufacturing to an information economy please recall the data presented at the beginning of this discussion. In 1978, 51 % of the U.S. workforce was employed in the information sector of the economy. Consider for a moment, one of every two working Americans is employed to collect, organize, or disseminate information. In the United States today, 7 of every 10 Americans are employed in the information and service sector while only 1 in 5 is employed in manufacturing. (Bernstein, 1983).

Even if the Computer Revolution stalls, one-half of all college graduates who are successful in obtaining jobs will find them in the information industry. The major obstacle in finding employment will be the lack of appropriate skills. In May, 1980, unemployment figures were at 7.6%. This was repeated in May,1981, yet the help-wanted index increased from 112 to 118 during that period (Parnell, 1982).

It seems unlikely that these jobs will remain unfilled for long and it seems unlikely that the Computer Revolution will stall. The Federal leadership has become aware of the trends noted in this discussion. While the Democrats may spar with President Reagan over high technology jobs, they also understand the need to move in that direction. In March, 1983 Senator Tsongas filed a bill which, if enacted, should accelerate that transition of this society from a manufacturing to an information economy (Congressional Record,March 1,1983). The purpose of this bill was stated as follows:

> A bill to establish a national technology education grants program to provide matching Federal assistance to joint initiatives by private industry, educational institutions, and State government to strengthen science, engineering and technical education, and for other purposes.

This statement of purpose appears innocent enough on the surface. However, if one reads the bill in its entirety and focuses on the items Senator Tsongas read into the Congressional Record it is more startling. I think that the Senator is attempting to ride a "sacred cow" over a potentially rough road.

Yet, it is encouraging to think that the economy of the United States may no longer be drifting and is indeed receiving some direction from the Congressional leadership.

It is a well accepted axiom that: "For every action there is an equal but opposite reaction.". For every revolution there is a counter-revolution. Evans (1979) expected such a counter-revolution to the computer, but he predicts that the forces of technology will win hands-down. In my opinion, the battle over technology was fought in the 1960's and 1970's. In that era, anti-technology authors, such as Slater, were very popular. Despite the popularity of these authors they seemed to have very little permanent impact as illustrated by the exponential growth of technology (Vallee,1982). While a successful counter-revolution is always possible, there seems to be little support for it at the present time. Personal experience suggests that the State and Federal governments, the mass media, and most people are in favor of high technology. Perhaps most importantly, the young are prominent in the computer culture (Goleman,1983).

Since computerization and the information economy seem likely to expand, it is reasonable to assume that most of the population of the United States has been (or soon will be) exposed to computers. There are numerous vocational opportunities spawned by the Computer Revolution. Projections suggest that there will be a continued shortage of computer professionals at all levels in the 1990's (Masat,1981). Thus, the question naturally arises:" What type of education will the citizens of this nation require to give them the opportunity to determine if they have the desire or potential to enter this field or, indeed, what knowledge will they need to just cope with computers?". Any attempt to address this wide range of needs can, in my opinion, be best served through a survey course in computer literacy. To reiterate, a survey format would allow students to develop a "feel" for computers and to determine if a career in that area is a realistic or desirable goal for them as individuals.

While some students will choose to become computer professionals, most will not. This suggests that a computer literacy course will be the only formal training that these individuals will receive in computers. Such students require sufficient terminology and computer concepts to continue their

education informally. A survey approach would best serve these needs of students.

Where does computer literacy fit into the college curriculum? This is a nagging question which disturbs some educators as it suggests a reallocation of resources. In my opinion, computer literacy should be considered a basic skill. As a basic skill, computer literacy needs to be addressed in the public school systems. (Hopefully, this will occur on a more uniform basis in the future.) As Hunter (1981) points out, since the public schools have, for the most part, failed to do this, it is incumbent upon the community colleges to promote computer literacy until the secondary schools are able to provide this service. In my opinion, community college students should be able to demonstrate that they have mastered the skills that have been identified with computer literacy. Mastery could be determined by a competency test. A computer literacy course could be offered as an elective to help students master the necessary skills.

From an organizational standpoint, the preceeding remarks might have been placed at the beginning of this paper. However, since they are the basic premises on which the following arguments are made, it seemed logical to present them at this time. These concepts may be reiterated briefly as follows:

1. In the coming decade most students will be required to use computers in their work.
2. A computer literacy course should be designed as a survey course.
3. Computer literacy is a basic skill and, as such, it is presumed that students taking such a course will have a relatively low level of knowledge in that area.

To resume discussion of the major components of a computer literacy course, if the reader will recall, the second item of content in the proposed course was stated as follows: the ability to operate modern hardware and use existing software. If most individuals will be required to use computers in their work and they are not programmers, then it follows that two minimum skills are required. These skills are as follows: 1. They must have sufficient knowledge of hardware to get on line and, 2. They must have the ability to use pre-existing software pertinent to their job. If not logical, it is at least reasonable to assume that even computer profession

will use and change software not of their own design. It also seems reasonable to assume that knowledge of existing software might be useful as models for future programmers. If these statements are true then the ability to use hardware and existing software is a universally required skill. Therefore, it should be a component of a course in computer literacy.

The question which arises is ; "What hardware and what software?". It is not practical to expose students to all existing hardware. Indeed, changes in hardware are occurring so rapidly that it is not reasonable to assume that the students will be working in the future with the hardware upon which they are trained. Therefore, the value of hands-on experience is in the"carry-over skills" or transferability of skills developed in such exercises. The system used should illustrate concepts as well as mechanical,manipulative skills. For this purpose, some type of microcomputer is probably most suitable. When using large time-sharing systems the user is often far removed from input/ output devices such as disks and diskdrives. Thus, these devices will be simply abstract concepts. In contrast, the microcomputer requires the student to be both operator and user. One example as to the usefulness of a microcomputer is to consider a peripheral such as a diskdrive. With a microcomputer the student must handle, format and mount his or her own disk. Thus the concept of mass storage is a concrete and abstract experience. Such understanding would be useful in recognizing the options available when situations arise such as limited disk space or the user's disk not being mounted when required. Having been an operator, the user is in a better position to judge the services that he or she can expect from a computer staff.

It would be ideal to train students on the actual software that he or she would be using in life. This is impossible, needless to say, as it has been estimated that 95% of the jobs that will be available in 1990 have not yet been invented (Niebuhr,1983). As with hardware, an important consideration in the selection of software is the transferability of skills. The software selected should contain mechanisms which are consistent with other user programs in common usage. Additionally, these programs should be relevant and immediately useful to the student. These programs should involve the student and demonstrate how the computers can be used to solve real problems. Programs of this type could be motivational for the student.

It has been mentioned previously that Computer Assisted Instruction (CAI)

should be a component of computer literacy. Not only does CAIs have relevance to the student at the moment but it has other advantages as well. The advantages and disadvantages of CAI will be discussed in my second position paper.

With respect to software, another important component in a computer literacy course should be wordprocessing. In addition to providing many "carry-over " skills, the student will find that wordprocessing has immediate value. The studebt may even be motivated to purchase his or her own personal computer. The application of word-processing to school work could save significant time, time which could be better spent in additional study or the pursuit of leisurely activities. The new software which checks for spelling errors should reduce the sighs of professors and improve student grades.

Some form of data capture programs should be a component of a computer literacy course. The information society will be based upon collecting, processing and distributing data. Therefore, it is reasonable to expect students to have some understanding of data storage. These programs (data capture) could also find immediate application by students. Such programs provide an excellect mechanism for storing references. References can be stored in the order in which they are read and later alphabetized and printed. Data capture programs also offer excellent storage facilities for information which one reads and envisions a need for in the future. This type of storage allows for future search by subject, author, journal or by whatever tidbit one can remember. The minimum level of proficiencies expected of students in word-processing and data capture programs are listed in Appendix B.

The third component of a computer literacy course was previously stated as follows: the ability to communicate with computer specialists by using correct computer terminology. It is this area which will be addressed now.

If the reader will accept the basic premise that : "All machines break down, even computers." then one may reason as follows: If one works with a computer,sooner or later it will break down. Therefore the user will have to communicate this difficulty to a computer technician or,if the individual is a repair person, then he or she must understand the user's problem and communicate the difficulty to the user. If these statements are true then it may be concluded that the need for computer terminology as a component of computer literacy is universal.

Teaching all existing computer terms would be burdensome to the student and probably beyond the expertise of the instructor. What criteria should be used in selecting terms? If computer literacy is taught in the format of a survey course then it should prepare the student to continue his or her education in a formal or informal fashion. Therefore, the terminology should be a foundation upon which to build a larger vocabulary. It is likely that a student will use many different systems and a variety of software during a lifetime. Therefore, the ability to read and understand a user's manual should be considered in selecting terms for a course. The minimum objectives for computer terminology are listed in Appendix C.

The fourth subject area of a computer literacy course was stated previously as follows: Knowledge of the social, political and economic impact of computers. In addressing this topic I must note that there seems to be a real but unconscious change in the purpose of Americation education. In defense of his bill to provide Federal assistance for joint ventures of industry and education, Senator Tsongas said,

> ....Why do I propose a partnership of this kind? Requiring industry participation would insure that the activities supported by this bill reflect the priorities of the private sector as it seeks to maintain American technological leadership.....

We can only hypothesize about the Senator's exact meaning but it creates the impression that the function of education in America is to be the handmaiden to high technology. My interpretation may be incorrect but recent remarks by Governor Dukakis seem to substantiate this view. At this point it seems prudent to refer to comments of a greater mind than mine to defend the inclusion of this fourth area in a course on computer literacy. The following argument was presented by Whitehead in the early 1900's to defend the introduction of science and technology into the educational system.

> The antithesis between a technical education and a liberal education is fallacious. There can be no adequate technical education which is not liberal, and no liberal education which is not technical: that is no education which does not impart both technique and intellectual vision....(Curtis, 1960)

If this statement is true then the subject matter of the humanities has a legitimate place in a computer literacy course. Perhaps the manner in

which this content area of a proposed computer literacy course was presented suggests an emphasis on current events. Admittedly current events would be an important segment of this section of the course but it would not be limited to such. Assigned readings would be used to develop questions of philosophy, ethics and manners.

Vallee (1982) reasoning from the axiom "Knowledge is power." has suggested that when one holds a file on an individual he or she has power over that individual. In the days of paper files it was not likely that sufficient information could be accumulated to do too much damage to an individual. Today, however, electronic files can be amassed using many different data banks which reveal almost every aspect of an individual's life. These statements suggest questions such as: What constitutes privacy in a data based society? and What is freedom in the new age?.

Given data and using inductive reasoning ,it is possible to create new facts which were not present in the original data. Vallee (1982) gives a good example of the type of unexpected information a computer can reveal. He writes about a bank which provided 24 hour service for the withdrawal of money. The computer revealed that most of the transactions using this machine occurred at night. Fearing that someone had learned how to "rip-off" the machine, the bank officials began an investigation. They discovered that individuals on their way to patronizing a near-by red-light district were stopping by the bank for cash. If one was sufficiently knowledgeable of the merchandizing practices in the local houses he could put this information into the system and identify individual patrons and the type of action each preferred. Such revelations suggest the ethical question; How far should a researcher go in interpreting data?.

In short, this section of the course would be "free-wheeling". It would be taught by assigning readings to students and then, in discussion format, consider the questions generated by the readings. There is only one behavioral objective for this section and that is : to develop thinking men and women.

The fifth and last area of content was stated previously as follows: The student should have an abstract concept of how computers work. This component would be designed to explore the technical aspects of computers.

If a computer literacy course is designed as a survey course then it should include all the aspects of the discipline. Therefore, it may be concluded that technical aspects are a legitimate component of computer literacy.

This segment of the course would introduce the binary system. The level of mastery would require only that the student understand how all numbers may be expressed as 0 and 1's. Once this concept has been mastered, computer memory would be considered. Following this, an overview of how computer chips are made would be presented. Lastly, the function of the components of the CPU would be considered. The specific objectives for this section are listed in Appendix D.

As was noted initially, there are two subject areas which perhaps should have been included but were not included. One area is that of consumer awareness. In the coming years, computer-related consumer goods are expected to proliferate at an even greater rate than they are experiencing now.(Deken, 1982). It would certainly be of value to an individual if there was some objective way to select computers and software. This would certainly be a worthwhile component in a computer literacy course. However, at the present time there is no way an instructor can keep up with the proliferation of new hardware and software, much less evaluate it. Even in attempting to teach generalizations,an instructor could find himself/herdelf on treacherous grounds. An instructor might make a common sense statement such as; "In selecting a personal computer be sure that there is a good line of software to support it.". Only to have a student inform him that p-system software has been perfected and now software will run on any system(Pearlman,1983). There seems to be no way to adequately do justice to the area of consumer awareness.

The history of computers is a second area that probably could be included in a computer literacy course but which I excluded. The problem is that I have not been able to find a good history of computers. What passes for computer history is rather like that section of the Bible where there are several pages of begats, naming everyone but not telling anything about them. The time is ripe for a historian to write a good book describing how each generation of computers has impacted humanity. After all, history should be the study of mankind and not just a list of machines.

The proposed content of a computer literacy course has been presented in very general terms. There is a good reason for this approach. The specific objectives listed in the appendices may be out of date when and if this course is offered. The specific content of this course was selected on the assumption that there were large numbers of individuals with little knowledge of computers. While this may be true now, it may not be true by the year's end. I have been told that in the Fall television season there will be three new shows related to computers.(I can not document this.) If this is true, then the level of computer knowledge should rise sharply in the population. It seems reasonable to base any computer literacy course on very general precepts. It is not likely that the broad categories treated in this paper will change rapidly. The specifics may have to be altered annually. Broad generalizations will allow an instructor to stay within the course description and yet meet a changing state of the art. This will allow a course to increase in depth as more computer literate students are encountered.

Up to this point I have been speaking of the components of a proposed computer literacy course and have not addressed the question; "What is computer literacy?". Computer literacy is, and should remain, a Rorschach test. True computer literacy is a philosophy of life. It is more that a set of questions or knowledge about tomorrow. A computer literate person is one who can meet his/her needs, achieve goals and find spiritual growth in a world of machines In this respect, it is likely that no one yet is computer literate. Even if this proposed course never serves a single student it is still labor well spent. The design of this course has cleared my thinking and allowed me to develop a personal definition of computer literacy.

> To be able: to find meaningful and useful employment
> in the 1990's; to live a thoughtful and dignfied life;
> and to have grace in the presence of machines.

## THE ROLE OF THE COMMUNITY COLLEGE

At a recent conference on Communications Technology in Education and training, a spokesman for the military was asked the following question; " What does the military plan to do about computer literacy?". The answer was; " Nothing. Wait ten years and the problem will go away."(Scanland,1983).

There seems to be good reason to believe this to be true. Hunter (1981) stated with some certainty that public schools have failed to provide a minimum level of computer literacy for their students. Today there are encouraging signs that this will soon be reversed. In the September,1982 issue of the American Biology Teacher, a journal primarily directed at high school teachers, a permanent section on computers has been introduced (Crovello,1982). A recent article in the Boston Globe tells of strides in computer education in the public schools (Cohen,1983). In Beverly,Ma., a 14 year old boy is conducting workshops for the faculty of that school district (Tracy,1983). Events such as these suggest that there is a rapid turn-around in the elementary and secondary schools.

Why then should the community colleges not take the attitude of the military? Why not wait and let the problem go away? The following statement by Wagschal illustrates the reason:

> Recent developments in computer technology have begun to create a widening gap between the two new and distinct groups in the American population- those who can and do use computers, and those who cannot. This gap is already leading to endless academic arguments over what constitutes "computer literacy" and to costly training programs in training a workforce which is, by any definition,computer illiterate. Unlike other forms of literacy, this problem is not centered on the young and hence easily resolved by changes in the public schools. A recent study by associations of word and data processors, for example, indicates that the most computer literate segment of the population is the 7-17 age range, while the least computer literate group is 35 and older.

In short, the most computer illiterate segment of this society falls in an age range which is the legitimate responsibility of the community college. While industry may be training and re-training many workers, others are discharged (Halberstam,1983). Even if one discounts humanitarian considerations such as the dignity and pride of individuals, there are numerous other reasons why these workers should not be ignored. Individuals between the ages of 30 and 65 are in what should be the most productive years of their life. They should be paying taxes and contributing to the economic stability of this society. Many of these people have children

and serve a useful social function by feeding, clothing and providing an education for these children. If they should not be able to continue to do this, the burden will fall upon the state governments already reeling under the burden of economic responsibility. What services can the community college provide? The first step should be to provide computer literacy courses in both the Day and Evening Divisions. Initially, these courses should deal with the most fundamental computer concepts. The next step would be to create a "micro-information society". Computer applications should be visible throughout the community college. Students should be exposed to computer-assisted instruction (CAI) and computer-managed instruction (CMI). They should use the computer to solve problems in math, physics and chemistry. In biology, economics and sociology students should use the computer to model. Data banks should be available through networks for research papers. These papers should be prepared using word-processing. In short, the students should be bombarded with computers from the day the new Data General assigns the first course until it prints out the credits for graduation.

Perhaps the most important function the community college can perform is to indicate that the Computer Revolution is a part of our American heritage. It is the goldfield, the cattledrive and the railroad. It is opportunity. Perhaps 95% of the jobs which will exist in 1995 have not yet been invented as noted by Niebuhr(1983) but there are fortunes to be made and fortunes to be lost. There are empires to be built and empires to be destroyed. Indeed, that is what America is all about!

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APPENDIX A

MODULE I OF THE BASIC MINICOURSE
OBJECTIVES

1. You will be able to control the order in which a program is executed by the use of line numbers.
2. You will be able to use the RUN,SAVE,and NEW commands appropriately.
3. You will know the difference between numerical and string variables.
4. You will be able to name variables in TRS-80 BASIC.
5. You will be able to store both numerical and string variables in memory.
6. You will be able to use the PRINT and INPUT statements.
7. You will know the symbols for addition,subtraction,multiplication,and division.
8. You will be able to control the order in which mathematical operations occur.
9. You will demonstrate that you have mastered these objectives by writing an original program using these skills.

MODULE II OF THE BASIC MINICOURSE

OBJECTIVES

1. You will be able to create a loop using:(1) GOTO (2) IF THEN and (3) FOR NEXT statements.
2. You will be able to create and use a COUNTER to control loops.
3. Demonstrate the above knowledge by writing an original program which will convert a series of Fahrenheit temperatures into Celsius.
4. You will be able to use the IF THEN statement for decision making in programming.
5. You will be familiar with the Relational Operators and where they occur in an IF THEN statement.
6. You will be able to use the AND and OR correctly in the IF THEN ELSE statement.
7. You will be able to generate random numbers using the RND(n) statement.
8. You will demonstrate the above skills by writing a program in which the user attempts to guess a number generated by the computer.

OBJECTIVES FOR THE BASIC MINICOURSE
MODULE III

1. You will be able to nest loops.
2. You will be able to do simple nesting of IF statements.
3. You will be able to use the DIM statement to create 1 and 2 dimensional arrays.
4. You will be able to place data in array variables and to manipulate it in a meaningful fashion.
5. You will demonstrate the above knowledge by writing an original program utlizing the above skills.

OBJECTIVES FOR BASIC MINICOURSE
MODULE IV

1. You will be able to assign a correct name to a file.
2. You will be able to use the options of the SAVE command.
3. You will be able to use the LOAD and RUN commands with their options.
4. You will be able to store data in a program using the READ and DATA statements.
5. You will be able to use the OPEN,PRINT#,INPUT#,EOF,and CLOSE statements.
6. You will have had the experience of saving and retrieving sequential files.

## APPENDIX B

## METHOD OF PRESENTATION
## of
## WORD PROCESSING MODULE

The module will be presented as a hands-on experience using tape cassettes.

## WORD PROCESSING MODULE

### SUBMODULE I

1. You will be able to load SCRIPSIT.
2. You will be able to position the cursor on the screen.
3. You will be able to print the screen contents.

### SUBMODULE II

1. You will be able to delete,overwrite,insert characters and lines.
2. You will be able to question the system about screen status,and change the screen parameters.

### SUBMODULE III

1. You will be able to exchange words and paragraphs.
2. You will be able to change the paragraph format.
3. You will be able to justify,center,flush left,and flush right.
4. You will be able to use comment lines and header blocks.

### SUBMODULE IV

1. You will be able to SAVE and LOAD documents from disk.
2. You will be able to type footer and page number blocks.
3. You will be able to change the screen width to match the print format.
4. You will be able to hyphenate the text.

### SUBMODULE V

1. You will be able to title a page and type a table of contents page using tabs.
2. You will be able to load a document and chain it to text on the screen.

3. You will be able to exchange,insert,and delete blocks.
4. You will be able to delete paragraphs and delete the end of the text.
5. You will be able to create an odd and even header block.
6. You will be able to type a footer block with page numbering.

SUBMODULE VI

1. You will be able to use the command mode to look through the text.
2. You will be able to repeat instructions,and make global changes.

## APPENDIX C

### MODULE I OF TERMINOLOGY MINICOURSE

I. You will be able to read and use the following terms in conversation with comprehension:

1. Hardware 2. Software 3. Application 4. Analog computer
5. Digital computer 6. Central processing unit (CPU)
7. Peripherals 8. Control unit 9. Primary storage
10. Arithemetic-logic unit (ALU) 11. Microprocessor 12. Bus
13 Internal registers 14. Word size 15. Read-only (ROM) memory
16. Random-access (RAM) memory 17. Bytes 18. Bit
19. Secondary storage (Mass memory) 20. Magnetic tape storage
21. Disks 22. Disk drive 23. "Floppy disk" 24. Formatted disk
25. Track 26. Sector

II. You will be able to describe how microprocessors differ.

III. You will be able to contrast tape and disk storage.

IV. You will be able to compare the differences between 4,8,and 16 bit microprocessors.

MODULE II OF TERMINOLOGY MINICOURSE

I. You will be able to read and use the following terms in conversation with comprehension:

1. Program 2. Low-order Languages 3. High-order Languages 4. Machine Languages 5. Assemblers 6. Compilers 7. Source program 8. Object program 9. Operating system 10. Time sharing 11. Batch 12. virtual storage

II. You will be able to contrast three of the high-order languages.

III. You will be able to generalize how operating systems are named.

## APPENDIX D

### MODULE I OF THE INWARD WORKINGS MINICOURSE
### OBJECTIVES

1. You will be able to describe how all numbers may be written as a set of 1's and 0's.
2. You will be able to write the largest number a single 8 bit byte may hold.
3. You will be able to state the number of bytes required to store an INTEGER variable on the TRS-80.
4. You will be able to state the number of bytes required to store single and double-precision variables.
5. You will be able to state the number of bytes required to hold a single string character.
6. You will be able to describe the ASCII code.
7. You will be able to explain why very large numbers or very small numbers are expressed as scientific notation by the TRS-80.

MODULE II OF THE INWARD WORKINGS MINICOURSE

OBJECTIVES

1. You will be able to contrast PMOS and NMOS transistors.
2. You will be able to define data,address,and control bus.
3. You will be able to state the advantage of registers.
4. You will be able to give the reason for the number of registers in the CPU being usually few in number.
5. You will be able to explain how two numbers are multiplied by a pocket calculator using two chips:a calculator chip and an I/O chip.
6. You will be able to describe the function of a single-bus,accumulator-based processor.
7. You will be able to explain why chip designers like to implement RAM on a chip.



ERIC Clearinghouse for Junior Colleges
8118 Math-Sciences Building
University of California
Los Angeles, California 90024

AUG 19 1983